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A grassroots sustainable energy niche? Reflections on community energy in the UK

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ABSTRACT

System-changing innovations for sustainability transitions are proposed to emerge in radical innovative niches. ‘Strategic Niche Management’ theory predicts that niche-level actors and networks will aggregate learning from local projects, disseminating best practice, and encouraging innovation diffusion. Grassroots innovations emerging from civil society are under-researched, and so we investigate the UK community energy sector to empirically test this model. Our analysis draws on qualitative case study research with local projects, and a study of how intermediary organisations support local projects. We examine the extent and nature of interactions and resource flows between projects and intermediary actors in order to evaluate the utility of niche theories in the civil society context. While networking and intermediary organisations can effectively spread some types of learning necessary for diffusion, this is not sufficient: tacit knowledge, trust and confidence are essential to these projects’ success, but are more difficult to abstract and translate to new settings. We discuss the implications of our findings for niche theory, for community energy and other grassroots practitioners aiming to build robust influential niches, and for policymakers.

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1. Introduction

The combined pressure of global climate change, threats to energy security and peak oil are driving a research agenda towards a radically more sustainable energy system (UKERC, 2009; Grin et al., 2010). The UK government's Low Carbon Transition Plan presents a national strategy for climate and energy which includes reducing energy consumption through conservation and efficiency measures, and the development of low-carbon electricity generation (HM Government, 2009). A key element of this plan is the role of households and communities, and the government's aim to "create an environment where the innovation and ideas of communities [in response to climate change] can flourish" (HM Government, 2009, p. 92).

Community energy projects are one example of this type of grassroots-led innovation, which aim to create more sustainable energy systems. They encompass a wide range of initiatives such as locally-owned renewable energy generation, community hall refurbishments, collective behaviour change programmes, and are claimed to bring additional public engagement benefits to top-down policy initiatives. Community energy has therefore been proposed as a new policy tool to help achieve the transition to a low-carbon energy system (e.g. The Cooperative and Co-operatives UK, 2012; Clark and Chadwick, 2011; DECC, 2014), but little is known about the scope and potential of such community-led innovations to influence wider transitions in the energy system.

To understand the dynamics of system transformation, we turn to theories of socio-technical change which have examined the role of protected 'niche' spaces as seedbeds of radical innovation. Niches are claimed to develop from clusters of sustainability innovations (projects), and in turn help new projects get established. Niches therefore help to diffuse innovations more widely, potentially becoming robust enough to compete with – and influence or displace – existing, less sustainable systems (Geels, 2005; Kemp et al., 1998; Raven et al., 2008). Strategic Niche Management (SNM) is a governance approach to nurturing niches as seedbeds of sustainable innovations, and identifies conditions and processes for niches to become robust and influential (Schot et al., 1994; Kemp et al., 1998; Hoogma et al., 2001). While research within this field to date has focused on managed technological innovation in market contexts, a growing body of work on 'grassroots innovations' is examining bottom-up civil society-led initiatives for sustainability (Seyfang and Smith, 2007). This work aims to better understand values-driven, community-based initiatives for sustainability, in order to support their growth and achieve wider influence. To this end, we aim to test the applicability of SNM to community energy, a grassroots innovation.

We present new empirical evidence from a study of the community energy sector (comprising many local projects) in the UK, and investigate the extent to which the activities and interactions between local projects and intermediary actors suggest that a community energy niche is evident (a full niche analysis is forthcoming). We draw on three main bodies of data: a set of 12 in-depth qualitative case studies of community energy projects; a review of resources available from networks and intermediary organisations representing the sector; and 15 in-depth interviews with key actors working at this intermediary level. We ask: can SNM adequately and usefully conceptualise our empirical

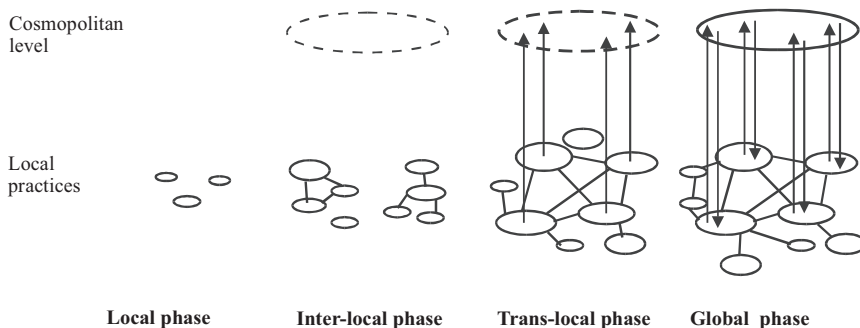


Fig. 1. Phases in the development of shared technological knowledge (Geels and Deuten, 2006: 269).

evidence? to what extent do the experiences of local projects and their interactions with networks and intermediaries suggest that a community energy niche is emerging, and at what stage of development is it? To apply and test SNM, we study how community energy projects might be contributing to niche development, and whether networking and intermediary organisations are effectively helping new projects establish themselves – these are essential niche-building activities for SNM. The paper proceeds as follows: Section 2 reviews the theoretical context of this work, identifying the areas of research which are currently under-theorised, and introduces the empirical case we study here, the UK community energy sector; Section 3 describes our methodology; Section 4 presents our findings, which we discuss in Section 5. We conclude in Section 6 with insights for policy and practice from the application of this niche analysis, and identify further avenues of research.

2. Theoretical context

2.1. Innovative niches for sustainability transitions

Theories of innovation for sustainability have adopted co-evolutionary models of social and technological systems to understand the drivers and dynamics of system-wide transitions (Geels, 2005; Grin et al., 2010). Sociotechnical systems (e.g. water, energy, transport, food) are theorised as ‘regimes’ existing in a state of dynamic equilibrium. They are resilient and therefore display technological lock-in and path-dependency, resulting in only incremental improvements in sustainability performance. Innovations for radical system-change must therefore come from outside the regime, and historical reviews of systemic transitions have identified innovative niches as an important source of radical innovation (e.g. Schot and Geels, 2008). Strategic Niche Management (SNM) aims to understand the conditions under which innovations for sustainability succeed, and guide governance of innovations for sustainability.

Niches are conceived as protected spaces where novel sociotechnical configurations are established (often as a direct response to an unsustainable regime), experimented with, and developed, away from the normal selection pressures of the regime (Smith and Raven, 2012). They are conceived as ‘cosmopolitan’ (i.e. not situated) spaces, constituted of multiple on-the-ground local projects, linked together by networks and intermediary organisations (Geels and Deuten, 2006; Hoogma et al., 2001; Raven, 2005; Raven et al., 2008; Hargreaves et al., 2013a,b). These intermediaries at the cosmopolitan or niche level consolidate the learning flowing ‘up’ from projects, and repackage it into mobile forms as transferrable standards, best practice and other resources to help new projects, who in turn re-interpret and embed the knowledge ‘downwards’ into new local contexts. In this way they aggregate learning and resources to help grow the niche through replication of projects, and influence regimes to adopt niche ideas and practices. Tensions in regimes, such as energy security issues, cast niche solutions in a positive light, thereby attracting interest from policy-makers and businesses in the regime.

Niche development is therefore seen as a necessary (but not sufficient) condition for the wider diffusion of innovative ideas and practices. Geels and Deuten (2006) theorise this process as a linear trajectory of a ‘cosmopolitan’ (i.e. abstracted, mobile) niche emerging over time from a group of local projects. Fig. 1 illustrates this model, moving from a set of isolated projects (*local* phase), through an *inter-local* phase where projects share knowledge and experiences on an ad-hoc basis and a niche level begins to emerge; followed by a *trans-local* phase where local knowledge is systematically fed ‘up’ to constitute the aggregated learning required at niche level, to a final *global* phase where the niche coordinates and frames local projects and becomes robust enough to influence or displace the regime.

Niche analyses of systemic change have studied the conditions under which niches become influential, with the potential to diffuse their innovations into wider society, and have identified three areas of activity which constitute effective niche-building: expectations, networks and learning. These suggest that: **expectations** about innovation performance contribute to successful niche building when they are robust (shared by many actors), specific, and of high quality (substantiated by ongoing projects); **social networks** contribute when their membership is broad (encompassing plural perspectives) and deep (representing substantial resource commitments by members); and **learning** processes not only

accumulate facts, data and first-order lessons about how to improve the innovation, but also generate second-order learning about alternative cognitive frames and different ways of valuing and supporting the niche (Kemp et al., 1998; Hoogma et al., 2001). Niche practices become influential to the extent that these three processes become robust enough to influence wider institutional changes (Geels, 2002; Raven, 2006), and these criteria form the basis of our empirical application of SNM.

Whilst useful, this basic model has problems. One, which our research counters, is that the niche-to-regime model simplifies a complex plurality of socio-technical configurations (i.e. community-led initiatives) into unrealistically homogenous niches working against a similarly problematic conceptualisation of an homogenous regime (Shove and Walker, 2007; Genus and Coles, 2008). This points to a second difficulty, which is the under-theorised relations between located socio-technical projects and the emergence of an abstracted, niche-level identity and interest, based around stylised, transferrable and abstracted socio-technical practices: what makes 'sequences of projects gel into a niche' requires further examination (Schot and Geels, 2008: 544) (see also Raven et al., 2008; Smith, 2007; Seyfang, 2009). This is problematic in terms of explaining niche development: how do community projects reinterpret, reinvent yet reinforce the generic, mobile lessons and norms constituting a niche? Theory is vague as to the precise roles of projects in niche-building, and the specific manner in which niches influence, coordinate and frame local projects, contributing to wider diffusion.

In analysing the potential of an innovation to influence wider systems, therefore, we need to assess the extent to which these processes (learning, networking, expectations) are occurring, and which phase of niche development (in Fig. 1) the sector appears to be exhibiting. Our empirical analysis will therefore apply SNM (examining the nature of interactions between projects and intermediary actors, to assess whether and to what extent a niche can be identified), and test its utility in this field, seeking to develop theory where needed.

2.2. Grassroots innovations

Most niche analyses to date have focused on market contexts and business-led technological innovations. In contrast, a growing body of work studying grassroots innovations frames radical community-based action for sustainability as an overlooked site of innovation for sustainability. This work seeks to better understand how they might be harnessed and supported to diffuse, to meet policy objectives for sustainability. Grassroots innovations are defined as:

"networks of activists and organisations generating novel bottom-up solutions for sustainable development; solutions that respond to the local situation and the interests and values of the communities involved. In contrast to mainstream business greening, grassroots initiatives operate in civil society arenas and involve committed activists experimenting with social innovations as well as using greener technologies." (Seyfang and Smith, 2007:585)

Grassroots innovations differ from market-based innovations in several key ways: their driving force is social and/or environmental need, rather than rent seeking; their context is civil society rather than the market economy; they display diverse organisational forms including cooperatives, voluntary organisations and community initiatives, rather than firms; their resource base is voluntary input, grant funding, mutual exchange, and reciprocal relations rather than business loans and commercial income; they are grounded in local and collective values, based on notions of solidarity, rather than efficiency and profit-seeking; and their niche protection consists of being a space for alternative – i.e. green, sustainability-oriented – values to be expressed, as opposed to shielding from market forces (Seyfang and Smith, 2007). Previous research with such initiatives has found that for participants, it is often the symbolic and shared practice of deep green values which brings the principal benefits, rather than any tangible economic or material impacts. E.g. local currency activists feel empowered by creating and using money which values people's labour equally; food activists highly value their ability to bypass supermarkets, even for relatively small proportions of their provisioning (Seyfang, 2009). These initiatives form 'pockets' of shared values different to mainstream norms, and communities of interest coalesce around them, in mutually supporting (hence, protective) spaces.

Recent studies have examined grassroots innovations in the context of complementary currencies (Seyfang and Longhurst, 2013a,b), energy (Seyfang and Haxeltine, 2012; Hielscher et al., 2013;

Hargreaves et al., 2013a; Geels and Verhees, 2011; Ornetzeder and Rohrer, 2013; Hess, 2013), food (Smith, 2006a,b; Seyfang, 2009; White and Stirling, 2013; Kirwan et al., 2013; Hargreaves et al., 2013b) and eco-housing (Avelino and Kunze, 2009; Seyfang, 2009; Smith, 2006a,b). While individual initiatives and sectors invariably differ from each other, a common finding across all these studies of grassroots innovations (which relates to their distinct characteristics), is the set of internal and external challenges they face in simply surviving, let alone growing, replicating and spreading more widely. These are: that they are situated in local contexts while facing pressure to scale up and become mobile/transferrable; that they need to fit in to situations they wish to transform; and they attempt to address structural problems with project-based solutions (Smith et al., 2013). Often initiatives fail to thrive because of an absence of long-term resourcing and institutional support. In addition, the radical values which often catalyse and inspire niche formation can clash with commercial and policy priorities, making the translation of innovative practices challenging, even with dedicated intermediaries. The importance of robust analysis of these initiatives is clear, then, both to assist practitioners in growing their projects, and to enable policymakers to harness the innovative energies of community groups working for sustainability.

In turning to SNM to understand grassroots innovations, we reframe community-led initiatives for sustainability as innovative niches, and seek insight into how these might be supported to overcome the challenges they face, and diffuse more widely. A SNM analysis should identify the interventions, resources, policies and interactions required to develop a robust niche with greater potential for influence. But it is unclear how applicable the lessons of SNM are in this civil society context where the nature of the innovations differ so markedly to those market-based niches more normally considered in the literature, and most importantly, where a niche emerges through a bottom-up process rather than through strategic management. In order to test the utility of SNM in this new setting, therefore, an empirical exploration of an emerging grassroots innovations sector is required.

2.3. *Community energy: a grassroots innovation niche?*

The last few years have seen a flourishing of community-led sustainable energy projects (hereafter 'community energy') in the UK, building on an historical foundation of alternative energy initiatives from the 1970s (Smith, 2005), and benefiting from recent policy measures to support the transition to a low-carbon economy. The term 'community energy' is applied to a wide range of initiatives with varying degrees of community involvement; here, we follow Walker and Devine-Wright's (2008) lead and consider community energy to refer to those projects where communities (of place or interest) exhibit a high degree of ownership and control, as well as benefiting collectively from the outcomes.

This is a pluralistic sector, encompassing multiple technologies, social institutions, business models, actors and goals. These grassroots innovations include both energy generation and conservation projects such as: village hall refurbishments introducing high levels of insulation and energy efficiency, combined with micro-generation technologies; collective behaviour change programmes such as Carbon Rationing Action Groups, Transition Streets or Student Switch-Off; community-owned wind turbines like those on the Scottish Isles of Eigg or Gigha; cooperatively-run small-scale energy systems, for example, Ouse Valley Energy Services Company (OVESCO) or Brighton Energy Cooperative. They are typically instigated or run by a diverse range of civil society groups, including voluntary organisations, cooperatives, informal associations, etc., and partnerships with social enterprises, schools, businesses, faith groups, local government or utility companies (Clark and Chadwick, 2011; Adams, 2008; Seyfang et al., 2013). Our survey of UK community energy groups found that while some were developing successful social enterprises, they were generally small in scale (three quarters had 10 or fewer core members) and two-thirds had no paid staff (Seyfang et al., 2013).

Policy support for community energy in recent years has arisen due to the sector's alleged ability to engage local populations in sustainable energy issues, improving public receptivity to renewable energy installations, increasing engagement in behaviour-change initiatives and reducing carbon emissions as a result. Thus, communities are seen as critical players in sustainable energy generation and energy saving efforts: "Community energy is a perfect expression of the transformative power of the Big Society" (DECC, 2010). To this end, several policy initiatives have explicitly aimed to catalyse increased community energy activity, and DECC's Low Carbon Communities Challenge (DECC, 2009)

aimed to learn from a series of exemplar projects: what potential they have to contribute to a low-carbon energy transition, and how best to seed wider change at the community level. In 2014 the UK government's Community Energy Strategy was published (DECC, 2014). However, the question of how local projects grow and spread, becoming transferable and generalisable, has not been addressed until now.

To what extent then, does it make sense to analyse this diverse sector as a niche? Here, we follow the lead of the actors involved: 'community energy' is an actor category, not our imposition. As activists, practitioners and policymakers describe themselves as a single 'community energy' sector despite internal diversity (representing shared beliefs about a sustainable energy future), and this evidence of dedicated networks, support groups, policy strategy, a growing number of local projects and recent academic interest suggests that a community energy niche may be emerging (Walker et al., 2006). If this is the case, then SNM may be able to inform future developments and provide insight into the most important future developments for long-term influence. To test the applicability of SNM in this context, we examine community energy's characteristics in terms of key niche-building processes of networking, learning and expectations, and the interactions between projects and intermediary actors.

By analysing the community energy sector using a niche innovation framework, we begin to understand the processes by which potential diffusion and harnessing for policy objectives might be aided. In so doing, we acknowledge that this is not unproblematic, and we recognise that not all projects wish to 'be harnessed' or scale up to meet policy objectives. Some groups and initiatives aim only to solve local problems – these we call 'simple' projects as opposed to 'strategic' projects which aim to have wider influence (Seyfang and Smith, 2007). Additionally, the community energy sector has objectives and goals which extend far beyond sustainable energy (into regeneration, community cohesion, tackling fuel poverty, etc.) which risk being squeezed out by the imperative to meet silo-d policy targets, and which demand a flexible holistic policy treatment.

3. Methodology

To test the applicability of SNM to community energy, we therefore look for evidence of a community energy niche being formed. To recap, this comprises local projects being involved in niche-building activities of learning, networking and expectation-management with intermediaries, and intermediary actors helping to support and replicate projects on the ground; we assess which stage of niche development (Fig. 1) is displayed by the sector, and what is required to further develop the emerging niche.

The findings presented here are drawn from mixed-methods qualitative research into the UK community energy sector, focusing on both project- and intermediary-level activities. The first strand of research involved twelve in-depth case studies of community energy projects (see Table 1), sampled principally for diversity of activity (of both supply and demand-side interventions) and pioneer (i.e. pre-2007)/follow-on replicated projects (in our survey of UK community energy projects, 21% were pioneers, established before 2007; Seyfang et al., 2013). Each of these studies comprises site visits and in-depth face-to-face interviews with 3–6 elite informants (e.g. founders and key partners), supplemented by document analysis of self-published material such as project websites. We investigated the objectives, activities, origins and developmental trajectory of the groups, and analysed the cases according to theoretically-informed themes around project-niche relations, learning, networking and expectations. These case studies were published as 'innovation histories' (Hielscher et al., 2012), charting the evolution of each group's project and highlighting niche-building-relevant activities along the way (see www.grassrootsinnovations.org). Coding (shown in Section 4) and analysis is theoretically-informed (projects working 'upwards' by networking, learning, expectations-building with intermediaries, and intermediaries working 'downwards' to support projects). Additionally, since networking (for drawing in resources) is a key aspect of SNM, we developed a qualitative social network analysis methodology to examine the nature and substance of significant network links from each project, coding each network tie for partner (local or national? energy-related or not? public, private or third sector? deep or shallow?) and the transferred resources (types of capital: manufactured, natural, social, human/organisational, financial, cultural (Porritt, 2007)).

Table 1

Twelve community energy case studies.

Name	Description	Energy domain	Country/setting	Started	Current status
Barley Bridge Weir Hydro Scheme	Cumbrian project to use a local weir for community owned hydro-electricity generation.	Supply and demand	England Rural	2007	On hold
Brighton Energy Coop	Aims to run and finance cooperatively-owned renewable energy projects. Recently established a solar PV project funded by public share issue.	Supply and demand	England Urban	2010	Growing
Bristol Green Doors	Community interest company promoting energy efficiency through retrofitting existing homes. Organises open eco-homes events.	Demand	England Urban	2009	Growing
Carbon Conversations	Runs community-based programmes of facilitated discussions on the practical and emotional challenges of low-carbon living.	Demand	England Urban	2005	Growing
Glasgow Carbon Rationing Action Group	Members self-impose carbon dioxide emission rationing, with targets and penalties; support and advice in group context.	Demand	Scotland Urban	2006	Continuing
Dyfi Solar Club	Sought to make solar water heating technology cheaper and more accessible.	Supply	Wales Rural	1999	Finished
Hyde Farm Climate Action Network	Raises awareness about domestic energy use, installs insulation to improve energy efficiency of local housing stock.	Demand	England Urban	2007	Growing
Isle of Gigha Heritage Trust	Community island buy-out in 2002 and regeneration programme includes wind turbines and energy efficiency projects.	Supply and demand	Scotland Rural	2006	Growing
Lyndhurst Community Centre	First New Forest community centre to install a biomass heating system, creating opportunities for local wood fuel supply.	Supply and demand	England Rural	2001	Continuing
Reepham Green Team	Informal network tackling issues of local community concern, e.g. school refurbishment and renewable energy generation	Supply and demand	England Urban	2002	Growing
South Wheatley Environmental Trust	Generating energy and revenue from their wind turbine, investing in local household, community and school efficiency and education projects.	Supply and demand	England Rural	2003	Continuing
Student Switch Off	Behaviour change campaign using prizes and competition between student halls of residence to encourage small energy-saving actions.	Demand	UK-wide Urban	2005	Growing

The second strand of research investigated the activities and resources of actors and organisations operating on behalf of local projects (the emerging niche-level) which might have the potential to frame and coordinate future projects. This consisted of 15 in-depth semi-structured elite interviews with representatives of intermediary organisations including national and regional NGOs, government bodies, and private sector companies. These variously act to initiate, network, support, fund, lobby for, promote and coordinate the community energy sector in the UK (see Table 2 and Hargreaves et al. (2013a,b) for a discussion of intermediary roles). These were sampled for: geographical spread throughout UK; supply-side and demand-side initiative support; and to capture the full range of intermediary roles. We also examined the resources provided by intermediaries to spread knowledge about community energy. We analysed the content of 113 reports produced by intermediary organisations (i.e. – produced by a third party, not self-produced) about specific local community energy projects, to assess the types of knowledge and information being conveyed (see Hargreaves, 2011; Hargreaves et al., 2013a,b).

4. Findings: applying SNM to the UK community energy sector

We apply SNM to the UK community energy sector to test its utility at explaining its evolution, and informing future development. We look for evidence of a community energy niche in the UK, as demonstrated by key criteria derived from SNM theory: project contributions to wider shared knowledge and learning, networking and shared visions (Section 4.1), and conversely, by intermediary organisations' influence and support in framing and coordinating new projects (Section 4.2). To the extent that one is found, we evaluate the phase of development it appears to be displaying. Our twelve cases were sampled for diversity, and we presume that any activities or findings that occur across all or almost all the cases, may be generalisable to community energy as a sector, and may additionally raise pertinent questions for further investigation in other domains of grassroots innovations (Flyvbjerg, 2003).

4.1. 'Upward' flows: are projects contributing to developing a niche?

4.1.1. Learning

Sharing learning is an important activity for our cases (see coding criteria in Table 3), as predicted by the SNM model of niche development, which indicates that the types of learning, and the people with whom it is shared, varies over time and according to different phases of the development of the sector. All our cases showed evidence of learning being shared 'upwards' with intermediary organisations who network and share experiences between local community energy groups (thereby contributing to knowledge aggregation and consolidation). Four of the groups did so to a 'high' degree (for example, developing replicable financial models); three did this to a medium degree (e.g. working with intermediary organisations to develop mentoring programmes) and five only to a low degree (such as when a project ends and learning is not formally consolidated) (Fig. 2). Interestingly, the intermediary organisations this learning was shared with were not necessarily or exclusively *sustainable energy* actors (see Fig. 3). The majority (10) did share their learning with energy intermediaries (such as Centre for Sustainable Energy, Energyshare, Energy Saving Trust) and almost as many (9) with wider sustainability-focused organisations (such as the Low Carbon Communities Network, and COIN). Furthermore, *all* the groups shared knowledge with other organisations beyond these, such as Highlands and Islands Enterprise, Development Trusts Association Scotland, community energy consultants, farmers, researchers, businesses and local government. Some of the learning has therefore contributed not necessarily to developing a community energy niche, but rather to supporting another niche such as renewable energy or community development instead – a subtle but important distinction for SNM which normally focuses on a single niche–regime interaction, and for potential niche efficacy.

The most prominent mechanisms for sharing learning were: being written about by intermediary organisations as exemplars in case study reports (10), filling in application forms for funding programmes (10) and engaging with intermediaries to develop transferable knowledge (9). These are all activities which suggest that for most of the groups, shared learning is something that others do *to*

Table 2
Intermediary organisations interviewed.

Name of organisation	Description of group's relevant activities and role as an intermediary					Energy domain	Area covered	Type
	Initiating	Networking	Supporting	Funding	Interfacing			
Energy Saving Trust		X	X	X		Supply and demand	UK	UK-wide NGO
Centre for Sustainable Energy		X	X	X	X	Supply and demand	UK	UK-wide NGO
Global Action Plan	X	X	X		X	Demand	UK	UK-wide NGO
Low Carbon Communities Network		X			X	Supply and demand	UK	UK-wide NGO
Transition Network		X			X	Supply and demand	UK	UK-wide NGO
Community Energy Scotland		X	X	X	X	Supply and demand	Scotland	Regional NGO
Community Renewable Energy		X	X			Supply	North-West England	Regional NGO
Development Trusts Association Scotland		X			X	Supply and demand	Scotland	Regional NGO
Marches Energy Agency	X		X		X	Supply and demand	Midlands	Regional NGO
DECC		X		X		Supply and demand	UK	Government department
Scottish Government		X	X	X		Supply and demand	Scotland	Regional Government
South East England Development Association		X				Supply and demand	Regional within England	Government organisation (disbanded)
Good Energy		X				Supply	UK	Private sector utility company
Independent consultant		X	X		X	Supply and demand	UK	Private sector consultant

Note: intermediary groups have the following roles (see [Hargreaves et al., 2013a,b](#)):

- **Initiating** new projects directly.
- **Networking** and sharing information between community energy groups.
- **Supporting** projects by providing tools (e.g. carbon calculators) and resources (e.g. good practice case studies and handbooks).
- **Funding**, managing and evaluating funding programmes.
- **Interfacing** with policymakers and energy companies to further develop community energy.

Table 3
Coding criteria for sharing learning.

Sharing learning with community energy actors	High	Medium	Low
With intermediaries	Groups are actively engaged in articulating their lessons learnt and experiences with intermediaries and circulating them between projects (sometimes becoming an intermediary themselves).	Groups engaged in circulating their lesson learnt and experiences with other groups that share the same approach (such as Transition Towns) and associated intermediaries (such as Transition network).	Groups interact with and potentially share their learning with intermediaries that are not directly connected to the community energy sector (such as Ben & Jerry's). In some cases the lessons are not consolidated and get lost along the way.
With other community groups	Developed infrastructure for sharing learnt lessons that could be accessed by other community energy groups such as mentoring programmes and project walking tours.	These groups also developed infrastructures for sharing learning (such as websites and booklets) but mainly for their own locality or approach rather than the whole community energy sector.	Groups did not actively articulate or circulate their learning.
Within the project	Groups exhibit active learning through direct experiences when developing and realising the project – such as learning by doing, experimenting and learning through dealing with failure.	Groups rely on the skills and knowledge members initially brought to the project, including past experiences that they gained working within community energy.	Groups had few applicable skills when starting the project and found it difficult to learn from their failures.

them, or extract *from* them, rather than groups doing it for themselves. In other words, learning is pulled rather than pushed ‘upwards’. Only half of the projects were actively engaged in formal evaluation or monitoring processes whereby learning was consolidated and passed to intermediaries, and therefore key lessons have frequently been lost at the end of projects. Occasional exceptions exist where community energy intermediaries work more closely with the initiatives, for example, Bristol Green Doors gained financial and advisory support to set up an Ecohome mentoring programme to aid the replication of their approach.

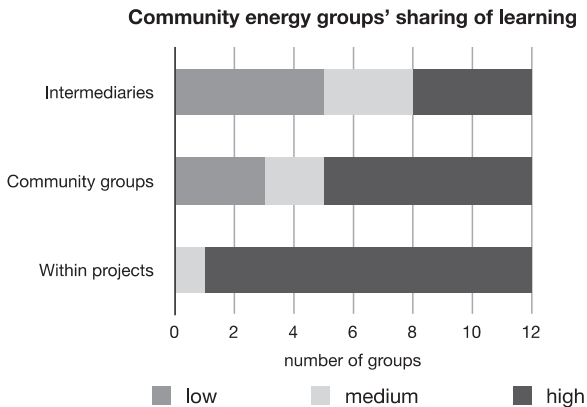


Fig. 2. The extent of community energy groups’ sharing of learning.

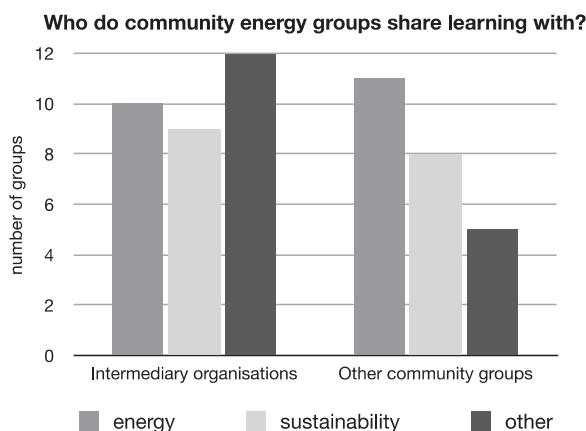


Fig. 3. Who do community energy groups share learning with?

In terms of what types of learning were shared, we found human/organisational aspects of projects were the most commonly shared (by 11 groups). The next most prominent was cultural capital (shared by 9 groups), and 3 groups shared social capital from their projects. Very few groups shared either financial or manufactured capital aspects of the work, and natural resources were not shared at all (see Fig. 3). The evidence suggests therefore that 'upward' flows of lessons and learning are not particularly strong, and quite a lot of the shared learning is going to intermediaries outside the community energy niche. What learning does flow upwards is pulled by intermediaries and policymakers, who can then select the lessons they wish to transmit to others (and perhaps have a more strategic overview of how to develop the sector for future growth); this is in contrast to the much weaker push of groups' lessons, where they themselves decide what is most important.

In contrast, sharing of learning directly with other community groups was much more evident, and was engaged with to a greater extent (see Fig. 2). The majority of groups (7) did this to a high degree; 2 medium and 3 low. The profile of organisations they shared knowledge with were different at this level: 11 shared learning with other community energy groups (e.g. similarly-focused local organisations, or other groups within their own specific 'family' of similar projects sharing a specific approach e.g. among Carbon Conversations projects), while two thirds (8) did so with wider sustainability-oriented community groups (such as local Transition Towns groups, Climate Action groups, etc.) and 5 with 'other' types of community groups (for instance Rotary Clubs, Women's Institute, church groups, ethnic minority groups, etc.).

The principal mechanisms of learning-sharing at this level were quite distinct to those in the 'upward' flow of sharing with intermediaries. At this level, they were mainly through peer-to-peer information sharing (meaning informal, ad hoc contact by telephone, email or at events, to acquire information and advice) which they ALL did, developing replicable models (9), and through hosting visits to their projects (7). Fewer were involved in mentoring other projects directly (5) and being a local test-bed for innovation (6), although this is a promising diffusion route: for example when local community energy initiatives came together to test a project idea (sustainable travel) in one of the villages to learn from it and then spread it more widely across the other villages involved. Some of the groups developed local newsletters and shared websites to provide infrastructural support for project-to-project information sharing with similar interest groups. These mechanisms all display an active push outwards of project learning to share with other groups, in contrast with the predominant 'pull' seen with intermediaries. This suggests that this project-to-project learning is more about what projects themselves find important. The substance of this learning shared project-to-project was human/organisational (ALL) such as carbon footprinting resources and advice; and cultural (ALL) e.g. conferences for group facilitators within a project 'family' to share learning but also offer moral

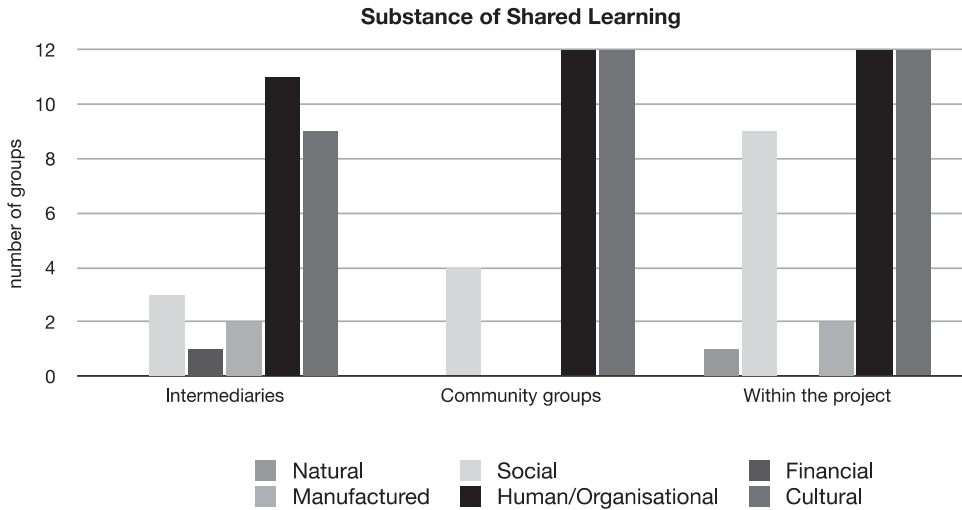


Fig. 4. The substance of what is shared by community energy groups at different levels.

support, and social (4) e.g. having overlapping memberships between groups to develop a critical mass of activists in the area (see Fig. 4).

In addition to these *outward-facing* processes of sharing learning with other groups and organisations, we found that learning plays an important role *within* groups in developing, improving and evolving community energy initiatives. The vast majority of our cases (11) engaged in this to a high degree. The most prevalent means through which this occurred was 'learning by doing', which was found in all the cases, and took the form of, for instance, adapting their activities to better suit local contexts and conditions and improve community engagement and effectiveness. All cases also drew on pre-existing expertise within the group, such as project management, form-filling, ideas for community engagement, etc. Reading around the subject and internet searches for information were significant sources of learning for 10 projects, and public meetings also generated project-level learning for 10 groups. The types of learning were principally human/organisational aspects such as developing the initiative's model and rationale (all 12 cases), cultural aspects (all 12) and social (9). This is because while some initiatives were extremely effective in attracting members that have the professional skills required to develop their projects (such as accountancy, project management and engineering), *all* the projects needed to learn and acquire additional skills and resources to successfully embed their project into the local context (including learning how to work as an effective group). This was often based on building what we have termed 'emotional stamina' – the determination, resilience and soft skills needed to deal with setbacks and lengthy project development phases.

To summarise this section, the evidence indicates that some learning is being shared upwards with community energy intermediaries, although mainly through being 'pulled out' by intermediaries, rather than being 'pushed out' by projects themselves through formal evaluations, monitoring and structured, codified learning mechanisms. These findings suggest that the projects are displaying characteristics typical of the second stage of niche development (inter-local – Fig. 1) where peer-to-peer shared-learning is most significant for projects, and niche-level actors are emerging but not playing a significant role in the process of aggregating shared learning. Furthermore, the niche being contributed to is not necessarily energy-focused but may represent wider sustainability, renewable energy, regeneration or community development interests for example. In contrast, projects are much more engaged with sharing learning directly with other community groups through informal, ad hoc channels – although again, these are not necessarily energy-focused. When we compare the extent of activity taking place at each level (Fig. 2), it is clear that sharing learning with community energy intermediary organisations takes second place to sharing learning with other community groups;

furthermore, sharing learning within the projects themselves is very significant to the projects' development and progress. In all of these cases, the learning being shared is overwhelmingly around human/organisational and cultural capital, as well as social capital aspects of running community energy projects. These are likely to be indicative of the grassroots innovations nature of the sector, reflecting the fact they simply do not have access to financial, manufactured or natural capital and, as such, it's unsurprising that we find social, cultural and human/organisational capital as the main things being learnt about. This does not, however, mean that groups are not 'reliant' on financial capital, nor that they wouldn't desire more of it if it were available.

4.1.2. Networking

Community energy projects engage in networking activities in a variety of ways, with a diverse set of partners, to gain support, information, and share their experiences (coding criteria is in Table 4). Projects can contribute to building cosmopolitan-level networks in a variety of ways, for instance through participating in network-level events, boosting memberships of intermediary organisations, applying and embedding intermediary-produced resources and tools, thereby increasing the sector's reach, and so on. There is good evidence that all our cases are engaged in *actively* contributing 'upwards' to network-building at this level (see Fig. 5). Some also have more passive, reactive or chance networking links with these partners, and a few have pre-existing network links to actors at this level. The main mechanisms by which this happens are: filling in online templates for funding applications or for intermediaries gathering data on the sector (11), media and publicity work in responding to public interest in their projects, or proactively seeking publicity to help develop their projects (11). Around two-thirds of the cases also attended intermediary-run events such as the Low Carbon Communities Network conference, etc., were a member of a wider network, talked to policy makers or lobbied directly, or worked with external consultants to produce materials and resources for the intermediary organisations. These activities helped to raise the profile of community energy and encouraged interactions between initiatives, but were sporadic and irregular. The main resources (capital flows) that are exchanged with actors at the global level are human/organisational capital (ALL), cultural capital (ALL) and social capital (4).

Table 4
Coding criteria for networking.

Building networks	Pro-actively	Reactively	Pre-existing
With intermediaries	Groups actively mentor other community energy initiatives as part of programmes set up by intermediaries, work with external consultants to produce learning materials for the community energy sector or talk about their project at network events.	Attending community energy events, filling in applications forms, becoming a member of a network.	Groups rely on existing relationships with intermediary organisations that they already had before starting the project.
With other community groups	Groups set up their own mentoring programmes, host other community energy initiative for a day or plan networking events.	Groups do not intentionally or strategically try to build relations with particular individuals or organisations, but rather connections occur accidentally.	Groups rely on existing community energy relations that they already had before starting the project.
Within the project	Groups conduct public meetings, talk with local decision makers and organisations and visit other community energy initiatives.	Groups do not intentionally or strategically try to build relations with particular individuals or organisations, but rather connections occur accidentally.	Groups rely on existing local friendships and contacts that they already had before starting the project.

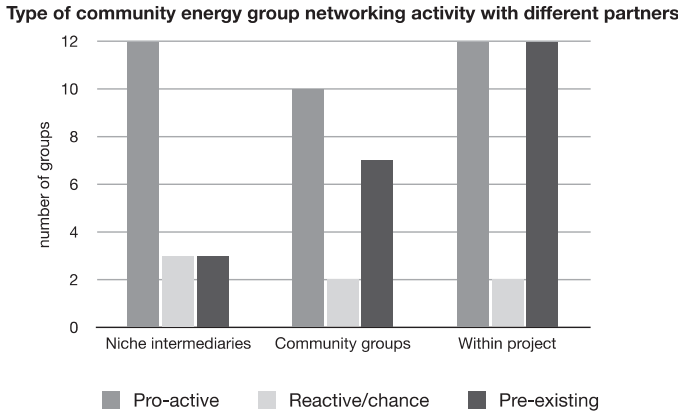


Fig. 5. Community group networking activities with different partners.

In addition to these contributions ‘upwards’ to network-building with intermediary organisations representing the sector, most of the groups were also pro-actively networking with other community groups (e.g. hosting visits from other community energy group members, or holding events to raise their profile) although at this level they were more reliant on pre-existing contacts (7) (Fig. 5). This mainly happened through being part of a ‘sustainability family’, for example developing connections between projects that share a particular model, and wanted to support each other and develop materials for wider diffusion – e.g. Transition Town groups, or Bristol Green Doors being part of a network of Eco-Open Home projects (9) and hosting visits from other community energy groups to come and see their work in operation (8), and holding community energy events (5). Formalised local mentoring was rare.

As before, the main resources gained from this networking at community group level is around human/organisational factors (all 12), and cultural capital (11), with some social capital (4) resources flowing too (see Fig. 6). In terms of having strong connections to other groups, our cases are principally connected to local sustainability ‘families’ (6 of the 12); others benefit from being located in a green milieu (i.e. a ‘hotspot’ for alternative green values and practices; for instance Brighton Energy Co-op’s investment drive was helped by a local populace sympathetic to their aims) (5), and only one is particularly rooted in a strong local culture dedicated to fostering regeneration.

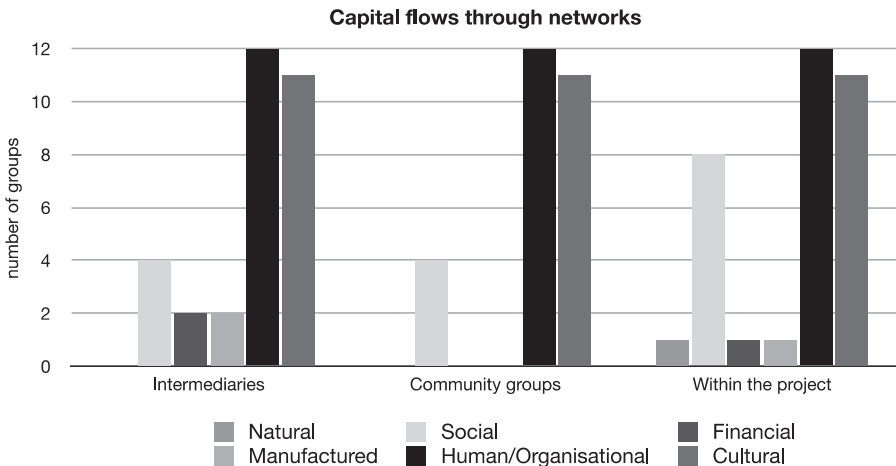


Fig. 6. Capital flows through network links with different partners.

Finally, we find that network-building within and around the community energy groups themselves is very important, in the development and operation of their activities. As Fig. 4 shows, all projects were actively engaged in network-building at project level, and they all also drew on pre-existing contacts to bring new partners and resources into the project. The main ways this within-project networking took place were through talking to local decision-makers to gain political credibility and influence (all 12 projects did this), drawing on informal personal (i.e. friends and family) contacts for support and resources (11), and pre-existing professional network connections from different sectors, e.g. accountants, lawyers, membership lists of other green groups, etc. (10), in both cases to bring in skills and expertise needed by the project. Holding public meetings (9) was another route to building project networks, identifying interested parties, local expertise and potential group members. This reveals the extent to which community energy projects rely on the skills-base, resources and prior contacts which members bring to the group, to get established and keep going. Again, human/organisational capital and cultural capital are the principal resources gained at the project level, but we see a much stronger flow of social capital into the projects at this level (8).

In summary, we find that networking is a vital aspect of the development of these community energy groups, and that while there is good evidence of contributions to global-level networking, as predicted by SNM in the formation phases of niche-development, there is more activity and reliance on pre-existing networks both between groups, and within individual groups, and with actors from other sectors/interest groups. This indicates again that the sector is currently at the 'inter-local' phase of niche development, showing greater reliance on project-to-project connections than those with intermediary organisations. At each level, though, the principal resources flowing through these network connections are human/organisational and cultural in nature. Again, this is unsurprising as these are frequently the only resources groups have access to, and are willing/able to share; they may have insufficient manufactured or financial capital to share that resource with others.

4.1.3. *Expectations*

The development of shared expectations and visions is considered a pre-requisite for robust niche development, and the role of local projects in this process is somewhat less immediate than in the previous sections, as this role is normally coordinated by intermediaries. We sought, therefore, evidence of coherence around visions and expectations between projects, as this would necessarily feed up to intermediary-level activities, interests (and indeed, the choice of which intermediaries to interact with).

The twelve cases had a diverse range of rationales and visions. All but one had sustainable energy objectives, while all twelve were motivated by wider sustainability goals, and seven also aimed to promote community development. These multiple and overlapping visions were expressed in various ways, for example Brighton Energy Co-op's mission statement covers several bases: "energy co-ops are powerful vehicles for engaging local communities on energy issues. Community-owned energy gives local people ownership of energy generation, makes those who receive the green energy less vulnerable to energy price increases, and empowers communities to improve their local environments" (Brighton Energy Cooperative, 2013). Given these typically broad-ranging aims, it is perhaps not surprising that the majority of groups (10) were aiming to achieve wider societal change beyond their own projects, which we can describe as being 'strategic' projects (i.e. having a clear direction and purpose). These groups were aiming to achieve a systemic change towards sustainability through the energy system and wider domains. Examples include Carbon Conversations who aimed to support widespread changes in daily practices and associated energy demand, and Brighton Energy Co-op who aimed to replicate their project and run several interlinked initiatives, growing in scale, market share and influence. Only one group was focused solely on achieving their own goals with no wider strategic aim, this was the Lyndhurst biomass project which wanted to refurbish their community centre and reduce their fuel bills, and we refer to this local solution-orientation as an example of a 'simple' project (after Seyfang and Smith, 2007). In contrast, Barley Bridge Weir Hydro Scheme began as a simple, locally-focused project, then evolved into something with wider objectives and became more strategically involved in the renewable energy sector as a whole.

We found that all the projects had very clear visions of their goals and objectives, and around half the groups have maintained their visions and over time (8) (meaning groups had formulated and

articulated unchanging, well-defined project aims, benefits and future promises and only had to adapt their ways of achieving them) while the others have evolved and adapted their aims and objectives (including adapting their intended benefits and future promises, as well as evolving new ways of achieving them). For instance, the Barley Bridge Weir Hydro Scheme started off wanting to develop a community-owned energy generation project but after conducting a public meeting decided to widen their aims, setting up various linked sustainability projects in the village around food, transport and energy. For these projects, the flexibility and adaptability shown by shifting priorities and visions has enabled groups to develop more successfully and engage more deeply with local populations, thereby continuing their existence and contributing to their success – even if the concept of success is redefined over time.

We explored the extent to which community energy intermediary actors influence or inspire the development of project visions and expectations (which would indicate propagation of a shared vision, and coordination of local projects demonstrative of an advanced phase of niche development), and were surprised to find that from our sample, *none* of the projects were originally inspired or instigated by intermediary-level organisations. Given that only two of our intermediary groups were actively involved in setting up new projects, and we sought community-led initiatives, this might not seem odd; however, we expected to find (as predicted by SNM) that more recently-established groups would have been at least inspired or informed by information and ideas transmitted by intermediaries, in the early stages of them setting up. This was not the case. Rather, two-thirds of the groups got their initial idea directly from hearing about or seeing other community energy groups, and a third were inspired by other types of organisation such as the Highlands and Islands Enterprise, District Councils, individuals developing the Carbon Contraction and Convergence model, and so on.

To summarise this section, the evidence indicates that there is not yet an influential niche able to shape the development of future projects within its overall shared vision, and that the sector currently exhibits characteristics of the ‘inter-local’ phase regarding shared visions and project coordination. As a result, the multiplicity of objectives and visions held by community energy groups contributes to a pluralistic sector, and one that has to date failed to unify around specific goals – not least because there is a distinction between groups pursuing energy generation objectives, and those solely focusing on energy conservation and demand-reduction. We do not claim that unification of visions is necessarily desirable from the perspective of community energy groups, but rather simply observe that the process predicted by SNM as necessary for niche formation is not evident.

4.2. ‘Downwards’ flows: are intermediary actors contributing to project development?

Section 4.1 has applied SNM to review the evidence of community energy groups’ activities around learning, networking and developing shared visions, in order to assess the extent of the projects’ contributions to the development of a community energy niche. A key purpose of niche development, of course, is to enable wider innovation diffusion through the provision of consolidated learning, best practice, business models, technical expertise and so on. The model claims that these can be ‘drawn down’ to enable new projects to start up more easily. In this section we examine the evidence for intermediary-level organisations providing resources to support the development needs of local projects, to assess the extent to which projects are supported on the ground.

4.2.1. Skills and resources offered by community energy intermediaries

Actors working within the community energy sector include dedicated energy intermediaries, policy actors such as local and national government, and private sector organisations such as energy utilities and independent consultants. The national, regional and local dedicated intermediary NGOs providing resources to would-be and established community energy projects include Centre for Sustainable Energy, Energy Saving Trust, Carbon Leapfrog, Marches Energy Agency, Low Carbon Community Network, and they are generally grant-funded (Hargreaves et al., 2013a,b).

The consolidated knowledge being aggregated at this global level is made available to new projects in various ways, most prominently in the form of documented reports about previous exemplar projects, and handbooks, toolkits and ‘how-to’ guides. In addition, these organisations may also initiate new projects themselves, offer advice and support, share information and establish network links

between projects, provide tools such as carbon calculators, and access to professional services such as financial or legal advice. Direct mentoring schemes exist (e.g. Community Powerdown was a collaboration between two Scottish intermediaries and local initiatives to share learning and provide more organised mentoring support, and in the early 2000s the Community Renewables Initiative adopted this approach) but are resource- and time-intensive, and therefore rare.

The ‘success story’ reports represent a common approach to help new projects, and are intended to provide a vital source of inspiration to local activists about what is possible, and encourage them to start new projects. These reports are usually quite short (2–3 pages long) and include key facts about a particular project: name, location, source of funding, start date, activities and results, etc., and often the key lessons learned by the projects (see Section 4.1.1 above). Our analysis of the learning conveyed in these reports indicates that a very wide range of lessons are identified, and that despite every best effort to learn from previous experience in the sector, each project faces some very context-specific challenges which will not necessarily be encountered by others or known about in advance.

Over time, these reports have come to be supplemented and even supplanted by more detailed handbooks and ‘how-to’ guides which provide more detail on the processes and challenges involved in developing local community energy initiatives. Where the exemplar reports focus on whole projects, these toolkits and handbooks concentrate instead on specific elements of local projects (e.g. around organisational structures; funding models; communications and consultation techniques, etc.) and, as a result, identify and aggregate learning about common features found in many types of project. Importantly, these generic processes are often illustrated with specific and detailed case studies that serve to demonstrate how these more general principles and processes must also, and always, be employed in locally appropriate and sensitive ways. This seems to represent a move forwards from general inspiration-provision which might be most appropriate for a nascent sector, towards aggregating (and providing) more detailed learning on the concrete issues faced by new groups within a maturing field.

In terms of policy support available to projects, there have been various funding initiatives – prize competitions, grants, etc. – which have sought to develop exemplars and learn about how to spread and grow community energy, e.g. DECC’s Low Carbon Communities Challenge. More recently, under the Conservative-Liberal Democrat coalition, a significant shift has occurred away from grants and the subsidy of upfront investment costs, and towards revenue guarantee schemes to encourage new forms of ‘community enterprise’. The Feed-in-Tariff, for example, provides guaranteed, above market rate payment for each unit of electricity generated from approved and certified, small-scale renewable electricity technologies. What this means for community groups is that they now have to adopt more business-like models, whereby they generate investment capital from sources other than grants. Other recent examples within this general approach are the Renewable Heat Incentive, the Green Deal for home energy efficiency measures and also Green Deal and LEAF (Local Energy Action Fund) whereby community energy groups bid to provide energy services to a funder or provider. The community energy intermediary organisations have responded by updating their advice and resources, but it seems that they struggle to keep up with a shifting policy landscape and moving targets, and this lack of stability in the sector is felt most keenly by local projects who find their plans are undermined by policy changes.

4.2.2. *Skills and resources needed by new projects*

Community energy projects need a variety of resources to get set up and become established (see Fig. 7). In the twelve cases we studied, the main areas of resources, knowledge and skills needed were:

- social (all cases) e.g. building supportive links with experienced or inspirational activists and groups to provide credibility, resources and advice;
- human/organisational (all cases) e.g. conducting a community carbon audit as a first step towards identifying potential projects; developing project marketing skills;
- cultural (all cases) e.g. being embedded within a prevailing alternative culture or strong local regeneration movement provided a solid basis for community support;

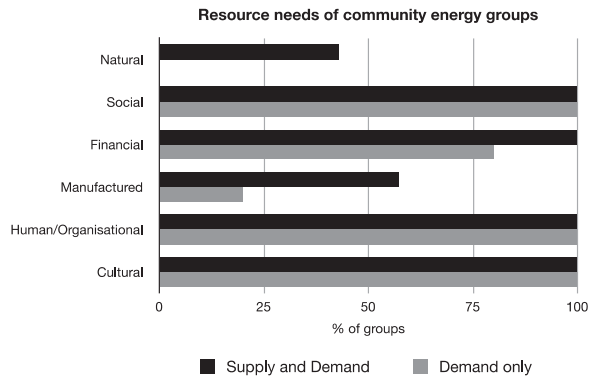


Fig. 7. Resource needs of community energy projects.

- financial (11 cases) e.g. grant funding needed to carry out the project, to buy equipment, pay for key staff, or premises, etc.

This was the only area where we found a distinct difference between those projects working on energy-generation, and those with only demand-side activities. Natural capital needs were exclusively identified by energy generation projects (3 out of 3, for example needing a piece of land to site a wind turbine, or finding suitable sunny locations for solar PV cells), and manufactured capital needs were primarily found in these projects too (4 out of 5) such as physical tools and equipment to carry out impact assessments and audits, feasibility tests, etc.

This demonstrates that community energy projects require 'soft' or 'people' skills, which are often as important as technical skills in overcoming challenges, building determination and persistence, and growing their projects. Similarly, in addition to interpersonal skills, initiatives need personal and emotional support to keep the project going in even the most challenging times. Here, in particular, face-to-face networking activities between initiatives can help, and knowing that other initiatives go through similar challenges can provide confidence.

Acquiring the resources to meet these needs was a key activity for the groups and essential for their development. All the projects we studied were pro-active in gaining the skills, knowledge and resources they needed; most of them drew on pre-existing knowledge and resources from within their community group; and a few also benefited from passive or chance encounters to access the resources they required. The groups drew on a variety of sources to meet their needs, both within and beyond the community energy sector.

All the groups were able to self-generate some of the resources they needed (perhaps by recruiting participants with particular skills, or by conducting research and training themselves, etc.), and they all accessed resources provided by intermediary organisations – but these were not necessarily energy-focused: two thirds of the cases gained skills, knowledge and resources from energy-specific intermediaries (primarily these were the energy-generating groups), two thirds from wider sustainability organisations (primarily the demand-side only groups), and all but one drew on resources from *other* types of organisation including parish councils, planning departments, council sustainability teams, statutory bodies such as Natural England and English Heritage, Universities, local farmers, freelance professionals, and energy utilities. In addition to these intermediary organisations, groups' needs were addressed through direct contact with other community energy groups (9), from national and local government support (9) and other sources (such as the church, solicitors, businesses, local organisations and farmers) (5).

4.2.3. *Where do local groups get support from?*

It seems that to some extent, the needs of community energy groups are being recognised by dedicated community energy intermediary groups and other actors working to support the sector:

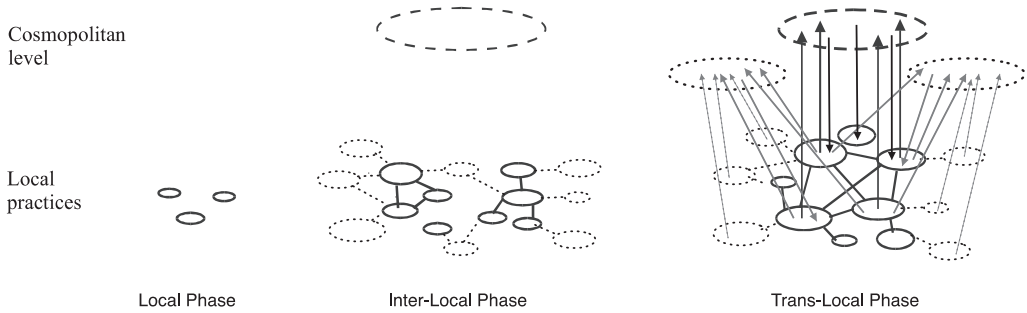


Fig. 8. Phases in the development of shared technological knowledge (adapted from [Geels and Deuten, 2006](#): 269).

financial support in the form of grant funding, dedicated investment funds, and community energy business models is available (though limited), and community energy organisations are disseminating lessons and inspiration to spread the ideas and inspire (and support) new projects. Technical advice, expertise, and inspiration are all on offer to help new projects become established. However, there are some critical needs which cannot be met through the provision of handbooks and toolkits, namely the need for social skills, confidence, emotional stamina to keep going even in challenging times, the ability to comprehend and apply unfamiliar and uncommon organisational structures, decision making processes and financial models, and a capacity for adapting generic models to local contexts. Finally, a stable and benign policy context is a critical need for the development of the sector, and while intermediary actors may lobby and attempt to open up supportive policy space to achieve this, their ability to do so is unclear (for further discussion, see [Hargreaves et al., 2013a,b](#)).

In addition, we see that community energy groups gain support and resources from a wide variety of sources in addition to dedicated community energy organisations – perhaps a mirror of the phenomenon seen in Section 4.1 where they are engaged with wider sustainability and community development organisations and fields, at least as much as with energy-specific ones. So from a project's point of view, only some of their needs are met by specific community energy intermediaries and they must look beyond this, to access the skills, knowledge and resources they require. From the intermediaries' perspective, they too are struggling in an unstable policy context, and are equally under-resourced and over-stretched in their objectives to support the sector. These groups are continually learning and updating their knowledge about how to best support projects and manage these demands within constrained budgets and capacities. This indicates that at present, there is not a particularly good fit between the support offerings of the community energy intermediaries, and the resource needs of projects, suggesting that there is not yet an effective niche able to coordinate and frame new projects, and diffuse niche practices.

In summary, returning to the stages of niche development in [Fig. 1](#), we see that niche level actors are beginning to attempt to support and influence the growing field of projects (as per Trans-local phase), but that this is not quite connecting with the needs of local projects. Instead, perhaps, we see evidence (from the projects' perspective) pointing towards other niches (renewable energy, community development, sustainability) drawn on for support, and with whom learning is shared. This is depicted in [Fig. 8](#), an adaptation of Geels and Deuten's diagram which aims to represent the complexity of project-to-intermediary relations we find, by opening out into more dimensions than a narrow community energy focus. We show links with non-community energy projects in dotted lines, and these other niches are represented by the dotted circles in the third phase. We discuss the implications of this, and speculate on the possibility of a final phase, below.

5. Discussion

In testing how useful SNM is for explaining developments in community energy, our analysis of the experiences of, and interactions between, community energy projects and intermediary niche actors reveals that there is indeed some evidence of an emerging niche of the type described in SNM

(identified by dedicated intermediary and network organisations, and policy support, and contributed to by local projects). In terms of the phases of niche development set out by Geels and Deuten (2006; Figure 1), the intermediary actors appear to be performing some of the roles typical of 'trans-local'-phase niche actors by attempting to aggregate projects' learning and sharing resources with new projects. In contrast, community energy projects themselves most strongly (but not exclusively) exhibit the characteristics of the earlier 'inter-local' phase, whereby project-to-project links are the most important and intermediary-level actors and organisations are only just emerging and beginning to play a role in their development – projects learn from and feed into a variety of potential niches, including community development, renewable energy, sustainability, etc. (see Fig. 8). This twin-track development is problematic for the SNM model, which claims that niches emerge from local projects in a linear process – we have found instead that niche-development characteristics of intermediary actors and local projects are progressing at different speeds, with no apparent causal link between projects' activities and niche formation. This 'twin-track' phenomenon which contradicts Geels and Deuten's model is beyond the scope of the current study, but is something we will return to in a future paper examining the niche development of the community energy sector as a whole.

Despite its achievements, what we have seen of this sector is indicative of a nascent and far from robust niche, which theory suggests is not yet able to exert strategic influence (i.e. with a clear direction and purpose) or diffuse more widely. On the basis of our study of how community energy projects are interacting with niche-level actors, our application of an SNM analysis indicates some possible routes for developing the sector in niche terms, to move from the 'inter-local' to the 'trans-local' phase, and a number of challenges to be overcome in so doing.

Principally, in order to become a more robust niche, SNM suggests that this sector needs a set of intermediary organisations with more capacity to consolidate and aggregate the learning and experiences of local projects, repackage them for implementation elsewhere, and lobby effectively for policy and industry support. At present, we see these intermediary organisations struggling with resource constraints and running to keep up with dynamic policy contexts in order to constantly update their understanding of what works, and continue to support projects on the ground. In addition, the policy demand for novelty in this sector, rather than underpinning existing services, means that intermediaries and community energy groups themselves need to repackage their activities for each new policy change and funding opportunity. Simultaneously, a diverse and dynamically-evolving variety of local projects are springing up and experimenting with new technologies and approaches, adapting to local contexts and changing conditions, yet without systematically capturing or sharing their learning, and without consolidation of models and techniques.

SNM suggests that better-resourced intermediary organisations could take the initiative in offering resources to new projects, transferring lessons from local projects, liaising with energy utilities and policymakers, and developing standardised models for easier replication. This 'pull' of learning up into intermediaries for consolidation is not unproblematic though, as we have seen that projects find it difficult to pro-actively 'push' their learning out, resulting in a filtering (through intermediaries) of the types of learning and lessons that are transferred. This raises questions about who 'speaks for' the sector, and what they choose to convey, with an attendant risk that what projects themselves find most important, is missed out in the effort to present the sector as palatable to policymakers, able to deliver on policy goals, etc. This could be countered by resourcing projects to effectively transmit learning on their own terms (as they currently do between themselves) so as to ensure that the developing sector represents their interests and does not close down broader interpretations and objectives of the sector. Face-to-face mentoring appears to be critically important in spreading ideas and practices successfully – groups like the personal contact, and this chimes with the importance of developing soft skills to grow these initiatives. Financial support for these dedicated sector-development organisations and networks is critical to help the sector coalesce into an effective niche, as is the exogenous condition of a benign and stable policy context within which to develop support mechanisms, best practice, advice and standards.

However, our testing of SNM in this context reveals that despite offering clear governance recommendations for the sector, the distinct grassroots innovative characteristics of the community energy sector presents additional challenges and demands attenuation of these SNM-derived prescriptions for niche development. First and foremost, though there is evidence of an emerging niche forming,

what we see in this civil society context of grassroots innovations is that it comes from the bottom-up, and is *neither strategic nor managed*. This has important consequences for the viability and resourcing of putative niche-level actors, and for the policy context in which they operate, as mentioned above. While community energy has successfully grown up in between the cracks of the mainstream energy system, it needs to be nurtured and supported (i.e. pro-actively supported, if not strategically managed) if it is to continue to grow and develop. This distinction is critical: to 'harness' or manage the sector may imply some kind of control or direction, which we argue may lead to dilution of the secret ingredient which makes community energy work: its core values.

Second, in a related area, the nature of the *protection* which this proto-niche benefits from presents a challenge for niche-development. The kinds of protection we see in grassroots innovations tend to be around spaces where stronger sustainability values are expressed and practiced (as opposed to market protection through subsidies and regulation, which is the norm in most SNM literature). While important for bringing together committed volunteers sharing certain values and ideals, and coming up with radical ideas for system-transformation, this protection is less practically helpful in terms of developing viable and well-resourced projects. It appears to be useful for the initiating stages of a project, but disempowering in the later establishment-and-growth stages. It is admirable and inspiring to see the amount of innovation and experimentation, commitment and dedication demonstrated by community energy activists, but this is not a sufficient basis for a viable future sustainable energy system. One potential pathway for the sector to mature and develop would be to transmute into commercial enterprises, and this would need dedicated work to develop commercial models and easily adoptable systems that can work in a wider range of communities. However we need to recognise that these translations might be anathema to project founders, and introduce tensions between the stronger and more broad-based strong sustainability values which led to the projects' original emergence, and pragmatic systems-building approaches. Another potential way forward is to challenge the narrow and constraining objectives for community energy which are imposed by policy frameworks and market discipline: rather than forcing projects to become businesses to compete and survive, a broader understanding of the value of such initiatives (recognising diversity, value-plurality, and non-monetary outcomes) might approach the sector differently and support their multiple activities and goals in other ways.

Third, there are certain types of resources widely available within community energy projects (principally social, human and organisational capital), and other types of capital are generally lacking (financial, natural or manufactured capital). These various capital resources may flow in different ways (or not flow at all) i.e. projects won't share their financial capital but might be happy to share human/organisational capital about different financial models, etc. Further, this point shows that modes and methods of diffusion matter greatly (i.e. some forms of capital can be emailed, others may require face-to-face learning or pre-existing longstanding relationships, to be transferable). Building on this, we emphasise that what matters is less the overall stocks of different kinds of capital or even perhaps the relative flows of capital, but rather the configuration of capitals on the ground, i.e. successful projects do not necessarily have 'equal' amounts of all kinds of capital, rather, they need particular configurations of capital – just enough financial, just enough human and so on – and this will differ from project to project. We see that, at present, community energy seems to be developing on the basis of particular kinds of capital and not others, which tells us about its current configurations (whether this is ideal or not is a different question). This nuanced characterisation of projects' resource profile helps us understand the potential strengths/weaknesses of community energy to cope with shifting contexts.

Fourth, given these resource configurations and requirements, we argue that the support needs of community energy projects are distinctive, and the resources offered by intermediary organisations to new projects needs to adapt to these and better meet their requirements, to enable more widespread diffusion and a better 'fit' within the sector. As we have seen, practical resource needs are important, but equally so are more 'soft skills' and social competencies such as confidence-building and moral support, to establish new projects and keep them going. Intermediary organisations are not fully meeting these needs at present; groups have to look elsewhere for those resources and support. For dedicated community energy organisations and networks to support projects more solidly would demand a high level of resource-intensive support, such as face-to-face mentoring and training workshops, which have also been among the first things to be cut back in the current economic climate.

Fifth, as community energy is so heavily grounded in local civil society and community engagement, some of the necessary project learning required to get initiatives up and running is particularly context-specific. But it seems that although community energy initiatives and intermediaries have developed generic and transferrable principles that are widely applicable within the sector, local groups need help and support applying those generic lessons in specific local contexts. Actors who want to support community energy might need to nurture infrastructures that aid the process of learning-by-doing and encourage pro-active learning interactions between groups of ‘do-ers’ to allow this tacit knowledge to spread (as it may not travel so well in the form of abstracted toolkits where learning is filtered and represented by intermediary actors), while consolidating generic principles thereof. Formal facilitated mentoring directly between projects might be one way of achieving this, but again resourcing issues are a constraint.

Finally, it has to be questioned whether this emerging sector will ever coalesce into a robust niche: although SNM developed around the model of single novel technologies, here we see many different approaches, technologies and social innovations bundled together into a community energy sector – the potential for these to align in terms of visions and expectations, performance and interests, is unclear. In the meantime, and as depicted in Fig. 8, we see projects sharing knowledge and experience with actors in a variety of sectors and fields, perhaps contributing to the development of sub-niches (the approach-specific families) or alternatively to broader sustainability niches around community development, renewable energy, sustainability and so on. This raises questions about the ‘scale’ and siting of niche analysis, and where support is most needed to strengthen the sector.

6. Conclusions

In this paper we have applied Strategic Niche Management (SNM) theory to a grassroots innovation sector, to test the usefulness of the theory at explaining the phenomena, and offering insight into how it may be further developed. We examined a set of UK community energy initiatives, and their interactions with intermediary organisations networking between and representing them, in order to establish to what extent they are displaying characteristics of a community energy niche – with the potential to diffuse and influence wider energy systems. We found that an emerging niche is evident, but it is at the ‘inter-local’ phase: neither strategic nor managed, and is rather incoherent in terms of its direction, content and substance. Projects tend to learn from each other rather than from dedicated networking organisations, and while intermediary organisations are beginning to gather transferrable lessons from projects, they cannot meet all the support needs of local groups. Despite the impressive growth of the sector in a context of inconsistent and constrained support, it is evident that the nascent niche we see is neither robust nor influential. Dedicated intermediary organisations struggle to keep up with changing policy priorities, and shifting policy contexts undermine local efforts to build projects.

Applying principles of SNM to this sector suggests a need for more positive policy support and interventions to improve the resourcing of intermediary organisations who can do the important work of consolidating and aggregating learning from local projects, thereby to better develop transferrable and generic lessons which can be diffused and implemented elsewhere. However, this sector has emerged spontaneously from civil society and sustainability-focused activists, and its grassroots innovation characteristics bring additional challenges. In this context, the principal predictions and recommendations of SNM require attenuation, as the presumption of benign policy context and governance interventions to support the emerging niche cannot be substantiated, and the sector’s diversity and plurality of visions challenge simplistic theories of innovation. While helpful, therefore, care and sensitivity is needed when attempting to apply these theories to grassroots innovations contexts.

To conclude, we argue that grassroots innovations, while offering a promising yet neglected site of innovation for sustainability, require attention and support beyond the governance prescriptions of SNM. If community energy in the UK is to contribute to a shifting energy mix, it requires imaginative policy support, recognition of its distinctiveness as an innovative sector (rather than attempts to make it fit the commercial ‘innovation’ mould, and appropriate support and resources. This might be more directed towards enabling a pluralistic and diverse sector to develop, free of constraining single-issue performance targets; it may require flexible institutional infrastructure which enables groups to find common ground along axes of values or visions as much as technological configurations; it may insist

that efforts to unify around singular goals and visions are put aside; and it might demand greater resource input to face-to-face mutual learning, rather than attempts to codify and standardise action on the ground. Community energy groups can be an influential and diverse force for change – rather than offering a single blueprint – if supported effectively and empowered appropriately.

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